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[0001] UNIT FOR CONTROLLING THE OPERATING FUNCTIONS OF A CYCLE

[0002] FIELD OF INVENTION

[0003] The present invention relates to control systems for cycles, particularly competition bicycles, although the invention is not limited to racing bicycles.

[0004] BACKGROUND

[0005] In the last few years, manufacturers developed cycling electronic control systems that control different functions. These control systems receive and process information gathered by sensors of different sorts, and obtain information regarding the operation and running conditions of the cycle.

[0006] These electronic control systems allow a user to control actuators of different sorts for modifying, according to given criteria and by acting both in an automatic way and via specific commands issued by the user, the operation/running conditions of the cycle. In particular, known controlled electrical actuators control the gear shift and the derailleur shift of a cycle.

[0007] Display units that allow a user to interact with the control unit are necessary for setting variables in the control unit. These display units contain a processor with storage capacity for storing information that may comprise sensitive information regarding the user and the user's cycle.

[0008] It is, therefore, useful to manufacture removable display units so that they can be separated from the electronic control system. When removed, however, it is important that the control system remain fixed on the cycle but protects the electrical connection points present on said "fixed" units from water, dust, impact, and tampering.

[0009] Exposure to the elements may jeopardize operation of the system and contribute to discharging the batteries of the units. Furthermore, the exposure of said

contacts to the external environment may lie at the basis of phenomena of electrostatic shock, which are able to jeopardize operation of sensitive components, such as microprocessors comprised in the system.

[0010] SUMMARY

[0011] The object of the present invention is to overcome the drawbacks outlined above and to propose a solution that enables insulation of the connection points and contacts when the display unit is removed. To this end, a unit electrically connected to, and selectively removable from, a complementary unit is provided. The unit controls the operating functions of a cycle so that said electrical connection can be decoupled by leaving exposed at least one distal contact part on both of said units. The electrical connection is at least one switch that can be selectively actuated for electrically insulating said exposed distal contact part from either of said units.

[0012] BRIEF DESCRIPTION OF THE DRAWING(S)

[0013] Figure 1 is a schematic circuit diagram of a system for controlling the operating functions of a cycle according to the invention in a first configuration of operation.

[0014] Figure 2 is a partial schematic circuit diagram of a system for controlling the operating functions of a cycle according to the invention in a second configuration of operation

[0015] Figures 3 and 4 show alternative embodiments of the solution described in Figures 1 and 2.

[0016] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0017] Figure 1 illustrates a partial block diagram of a system 2 for controlling the operating functions of a cycle (not shown in the drawings). In general terms, such a system is described in the Italian Patent Application TO2000A000293 to the assignee of the current application (which corresponds to U.S. Patent Application No.

09/805,113 and publication number US2001-0027495 assigned to Campagnolo S.r.l.), which is incorporated by reference as if fully set forth.

[0018] The system 2 comprises a display unit 21, a control unit 22, and a power unit 23. The control unit 22 and the power unit 23 are preferably fixedly mounted on the cycle. The display unit 21 is, in contrast, removably mounted to the cycle.

[0019] The power unit 23 provides for management of the positioning requests for the gearshift and for the derailleur, and controls the operation of a gear-shift actuator 14 and a derailleur-shift actuator 15, both of which are associated with respective position transducers 16 and 17.

[0020] Said position transducers 16 and 17 provide the information on the position of the gearshift and of the derailleur-shift to the power unit 23 so as to enable optimal control of the actuators 14 and 15 and execution of procedures, such as zero-setting of the position of the actuators and compensation for drifts or offsets of this position.

[0021] The power unit 23 supplies the control unit 22 by means of a connection 102 coming under a supply bus 103, with associated a communication bus 104. A connection 105 extends the buses 103 and 104 to the display unit 21. The connection 105 is decouplable, i.e., it is detachable, to enable removal of the display unit 21, separating it from the rest of the system.

[0022] The connection 105 is realized by a suitable four-conductor male-female connector or else by sliding contacts, so as to have contacts 107 on the control unit 22 and corresponding contacts 108 on the display unit 21. Said contacts are represented schematically in Figures 2 and 4 only.

[0023] A microprocessor 27 is connected in parallel on the communication bus 104. The microprocessor 27 has inputs 28 and 29 for receiving respective controls corresponding to the gearshift and to the derailleur-shift. The microprocessor 27 thus provides for forwarding said commands, through the communication bus 104, to the power unit 23. The control unit 22 comprises an auxiliary supply circuit 30, which monitors operation of an auxiliary battery 34 for the microcontroller 27.

[0024] The display unit 21 comprises a display 24, driven by a microprocessor 25. The microprocessor 25 is designed for performing the cycle-computer functions and for communicating, by means of the communication bus 104, with the control unit 22.

[0025] An auxiliary supply circuit 26 monitors, in a known way, operation of an auxiliary battery 33 for the microcontroller 25.

[0026] The display unit 21 further comprises a magnet 31 located in the proximity of the connection 105. Three magnetic switches 32, preferably of the reed-switch variety, are activatably closed by proximity to the magnet 31. These switches are placed on the communication bus 104 and on one of the conductors of the supply bus 103. Consequently, when the display unit 21 is mounted on the cycle, the magnet 31 keeps the magnetic switches 32 closed. When the display unit 21 is removed, the magnet 31 mounted on it moves away from the magnetic switches 32 and the magnetic switches 32 open. When the switch is open, the distal ends 107 of the lines are insulated from contact.

[0027] Consequently, the possible exposure of said distal ends 107 to the external environment and to external agents is not able to have any influence on the control unit 22 (or on the power unit 23 since the aforesaid distal ends 107 are physically separated and isolated from the units 22 and 23 mounted on the cycle.

[0028] Figure 2 shows the display unit 21 removed and displaced with respect to the control unit 22 by a distance such that the magnet 31 no longer exerts its force on the magnetic switches 32, which are in an opening position.

[0029] In particular, even though the contacts 107 remain uncovered and exposed, the corresponding conductors that belong to the supply bus 103 and to the communication bus 104 cannot, for example, be short-circuited by humidity that has condensed on top of the contacts 107. Said contacts 107 are in fact physically separated and isolated from the aforesaid conductors of the communication bus 104 and of the supply bus 103.

[0030] There is thus prevented any battery discharging phenomena through the connection 105. Likewise, any electrostatic charge transfer phenomena, through the

connection 105, to the buses 103 and 104 and to the devices associated to them is prevented.

[0031] In the example illustrated, said conductor is, in fact, the ground conductor of the supply bus 103, which is unlikely to be able to give rise to the adverse phenomena referred to previously, also because the three reed switches in any case prevent formation of a return line. It is, however, clear that both of the conductors of the supply bus 103 may be provided with switches such as the switches 32.

[0032] The variant embodiment illustrated in Figures 3 and 4 (corresponding, respectively, to Figures 1 and 2 in general terms) adopts the same circuit scheme described previously. For this reason, the same references that already appear in Figures 1 and 2 have been adopted in Figures 3 and 4. Figures 3 and 4 show that the contacts (distal ends) 108 of the connection 105 located on the display unit 21 are similarly protected as those on the control unit. Also in this case, the mechanism of protection – based upon the physical isolation of the contacts 108 from the unit 21 and the components that are located inside it – uses a plurality of switches 35.

[0033] For this embodiment, the switches (preferably of reed bulbs) are, however, located on the display unit 21 so as to enable their operation by a magnet 36 placed on the control unit 22. Consequently, when the display unit 21 is mounted on the cycle, the two units 21 and 22 are close to one another and, just as the magnet 31 keeps the switches 32 closed, the magnet 36 keeps the switches 35 closed. The connection 105 consequently presents an electrical continuity feature, fully performing its function.

[0034] Conversely, when the display unit 21 is removed from the cycle, the two units 21 and 22 are moved away. The magnet 31 is no longer able to keep the switches 32 closed, and the magnet 36 is no longer able to keep the switches 35 closed. With the switches 32 and 35 open, the contacts 107 and 108, which have remained exposed as a result of removal of the display unit 21 and interruption of the connection 105, are thus physically isolated from the respective units.

[0035] Regarding the choice of the number and arrangement of the switches 35, the positions of installation of the magnets 31 and 36 are chosen in such a way that the

magnets are not reciprocally affected, in particular, to prevent the magnet 36 from keeping the contacts 32 stably closed, and/or the magnet 31 from keeping the contacts 35 stably closed.

[0036] The system for controlling the operating functions of a cycle proposed herein enables automatic insulation of the points of connection on the control unit and/or on the display unit to be achieved through an interruption of the physical continuity of the signals from and towards the outside of said units.

[0037] Advantageously, the insulation obtained by the system according to the invention does not prevent the control unit and the power unit from operating independently.

[0038] The use of magnetic switches in the form of reed-bulb switches is particularly advantageous on a cycle, since it is exposed to considerable vibrations, and the reed switches should be resistant to such vibrations. In addition, the magnet on the display unit and/or on the control unit is an inexpensive device that does not require any sort of power supply.

[0039] However, the reed-bulb switches may be replaced by magnetic or electromechanical devices, such as other types of mobile-element relays or Hall-effect-sensor relays, or else by switches, in particular switches controlled by means of other types of signal, such as an optical signal or a radio-frequency signal, or other types of sensors or proximity devices designed for inducing switching of a remotely located switch.

[0040] The magnetic switches set on the control unit 22 and/or display unit 21 and the magnet placed on the display unit 21 and/or control unit 22 realize a proximity switching device that is activated for switching when the display unit 21 is removed or else installed on the cycle. Such a device may be built in a functionally equivalent way in many different forms.

[0041] By way of example (and without wishing in any way to exhaust the field of possibilities), the following solutions may be used:

[0042] - proximity switches of a mechanical type;

[0043] - proximity switches of the solid-state type, such as photoemitter-photodetector pairs;

[0044] - optical switches, such as photocells or photodetectors in general, which are able to be exposed or obscured according to whether the display unit 21 is removed or else mounted on the cycle;

[0045] - electromagnetic-field or ultrasound proximity sensors.

[0046] The control system may be designed so that the control unit 22 detects opening of the switches caused by removal of the display unit 21 and in said conditions, prevents operation of the system itself. Alternatively, the control unit 22 may be configured for detecting opening of the magnetic switches and implementing a set of basic locomotion functions, such as gear-shifting and derailleur-shifting, ensuring execution thereof in conditions of removal of the display unit from the cycle.

[0047] From what has been set forth above, it follows that, without prejudice to the principle of the invention, the details of implementation and embodiments may vary widely with respect to what is described and illustrated herein, without thereby departing from the scope of the present invention, as defined by the annexed claims.

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